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For:	PARTS OF IGNITER		

VERIFICATION OF TRANSLATION

Assistant Commissioner of Patents
Washington, DC 20231

Sir:

I, Takahiko MIZOBE, Chartered Patent Attorney of Furuya & Co., located at 6th Floor, Hamacho-Hanacho Building, 2-17-8, Nihonbashi-Hamacho, Chuo-ku, Tokyo 103-0007, Japan, declare that:

1. I am well acquainted with the Japanese and English languages;
2. I verified the translation of the above-identified non-provisional patent application from Japanese to English language; and
3. The hereto-attached English translation is a full, true and correct translation of the above-identified non-provisional patent application to the best of my knowledge and belief.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Dated: March 17, 2004 ______________________________

Takahiko MIZOBE

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non-provisional

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Description

PARTS OF IGNITER

Technical Field of the Invention

The present invention relates to parts of igniter used for an igniter suitable for various kinds of gas generators for an air bag and a method of manufacturing the same.

Background Art

In various kinds of gas generators for an air bag, a reliability of activation becomes considerably important element from the viewpoint of safety assurance of a passenger. For this reason, importance of an igniter which is actuated after collision of a vehicle to ignite and burn a gas generating agent for inflating an airbag is high.

The igniter includes electroconductive pins and a heat generating body as constituent elements, in which the heat generating body starts heat-generating by current flowing through the conductive pins and a priming is burnt thereby so that the gas generating agent is ignited and burnt through combustion of a transfer charge arranged if required. Since such a course is taken, it is required that an electric current flowing in the electroconductive pins flows into the heat generating body reliably in a first stage of actuation. The followings are known as the prior arts relating to such an igniter.

JP-A 2001-235300 discloses a technique relating to an invention concerning a method for welding bridge wires in a plug

for an electric igniter, in which a heat generating body is spot-welded to end portions of electroconductive pins in the head. A thin wire (wire diameter of 26 to 36μm) of an alloy including nickel-chrome as a main component is used as a heat generating body.

In the technique, since the heat generating body is extremely thin, welding must be performed in such a state that a welding terminal presses the heat generating body against an end portion of the electroconductive pin perpendicularly. When a mistake occurs in the welding, namely, a portion of the welding electrode comes in contact with a header or the like, one portion of a welding current flows through the header in a branching manner, which causes welding failure between the heat generating body and the electroconductive wire. Further, when an electric current become excessive at a time of welding, the wire is melted and when an electric current become short, welding becomes insufficient.

If end portions of electrodes are disposed on one end surface of a header (a part 11 shown in Fig. 1 of JP-A 2001-235300) having a flat plane portion and the heat generating body is mounted between the end portions on the same flat surface by welding or the like, with a unflat mounting surface, there is such a risk that the heat generating body may be disconnected. Therefore, polishing for removing undulation or the like is required in general.

In the technique, since conditions for welding are directly linked with a reliability of a product directly,

management of a welding electrode (management for replacement frequency, degree of verticality or the like) and management of a welding current become important.

JP-B No. 3175051 discloses an invention relating to an electric ignition type initiator.

A heat generating resistance substrate 20 is provided on a cylindrical glass hermetic 11, and through-holes 20a are formed at positions corresponding to electroconductive pins 12. Further, electroconductive areas 21 are provided on the substrate 20, and a resistance element 22 is formed between the areas 21. Since the electroconductive pins 12 and the electroconductive areas 21 have been joined by solder or electrocoductive adhesion 23, it is necessary to prepare the solder or electroconductive adhersion separately. In particular, when joining is performed using a solder or an electroconductive adhesion, there occurs a problem regarding reliability of the joining. For example, when a joining surface is dirty with, for example, oil, there occurs a risk that a solder may be repelled and a joining force lowers, so that a joining failure occurs due to repetitive stress caused by vibrations during a vehicle driving.

JP-A 2001-194094 discloses an invention relating to a detonating agent. According to Fig. 1 and Fig. 2, and descriptions corresponding thereto, holes 22 and 23 are formed in a heat generating portion (a flat plate resistance element) 17 formed on an insulating substrate 16, and electrodes 12 and 13 penetrate the holes. However, in the publication, there is

not any disclosure about a method for joining electroconductive metal regions 28 and 29 and the electrodes 12 and 13.

Disclosure of the Invention

One object of the present invention is to provide parts of igniter which, when applied to an igniter for a gas generator for an air bag, can elevate an activation reliability of the igniter and can improve a reliability as a product of a gas generator.

Another object of the present invention is to provide a manufacturing method of parts of igniter, which can manufacture the above-described parts of igniter by a simple method and at a low cost.

The invention according to claim 1 provides, as a means for solving the problem, parts of the igniter comprises a header, heat-generating body and a single or plural electroconductive pin, wherein the electoroconductive pin penetrates from one end surface to the other of the header, and heat-generating body is interposed to be fixed between a one end portion of the electroconductive pin on the one surface of the header and a surface of the header.

The heat generating body may be one in which a heat generating portion is formed on a proper substrate, as well as such one as an alloy wire generating heat.

The number of electroconductive pins is at least one, and two or three or more electroconductive pins can be used according to a structure and a function of an igniter.

In the invention described in claim 1, by applying a method of physically holding the heat generating body by using one end portion of the electroconductive pin, as a holding means for the heat generating body, use of a solder and an electroconductive adhesion is made unnecessary so that a problem occurring when these are used can be eliminated. Further, since complicated welding, soldering or the like is made unnecessary, a manufacturing cost is also reduced.

The invention described in claim 2 provides parts of igniter described in claim 1, wherein a portion of the one end portion of the electroconductive pin opposite to the header surface is flat and a portion of the one end portion of the electroconductive pin not opposite to the header surface is not flat, and the heat generating body is sandwiched and held between the flat surface and the header surface.

Since the portion opposite to the surface of the header is flat, when the heat generating body is sandwiched between the flat surface and the surface of the header, a holding force for the heat generating body is elevated.

The invention described in claim 3 provides parts of igniter described in claim 1, in which the one end portion of the electrocoductive pin has a flange portion and the heat generating body is sandwiched and held between the flange portion and the header surface.

Since the flange is flat, at the time of interposing the heat generating body between the flange portion and the surface of the header, a holding force for the heat generating body is

elevated.

The invention described in claim 4 provides parts of igniter described in claim 1, in which the one end portion of the electroconductive pin has a groove formed in the radial direction, and the heat generating body is sandwiched and held between the groove and the header surface.

Since the heat generating body is sandwiched between the groove and the surface of the header, a holding force for the heat generating body is elevated. Further, the heat generating body is simply fitted into the groove, so that it is also made easy to position the heat generating body.

The invention described in claim 5 provides, as another means for solving the problem, parts of igniter including a header, a heat generating body and a single or plural electroconductive pins, wherein the electroconductive pin penetrates the header from one surface thereof to the other surface, and the heat generating body is sandwiched and held in one end portion of the electroconductive pin positioned on the one surface of the header.

As well as an effect similar to that in the invention described in claim 1 can be obtained, since the heat generating body is sandwiched and held only in the one end portion of the electroconductive pin, the heat generating body can be held without being influenced by a shape or a surface condition of the header.

The invention described in claim 6 provides parts of igniter described in any one of claims 1 to 5, where the heat

generating body is constituted such that a contacting portion coming in contact with the one end portion of the electroconductive pin and a heat generating portion generating heat with an electric current are formed integrally on a printed substrate.

By using such a printed substrate in this manner, formation of the heat generating portion of the heat generating body can be facilitated and a holding work for the heat generating body can be facilitated, and additionally, disconnection in the heat generating portion hardly occurs, as compared with the case of an alloy wire welded and fixed as the heat generating body.

The invention described in claim 7 provides parts of igniter described in claim 6, in which the heat generating portion of the heat generating body is an S-shaped one formed by etching.

By forming the heat generating portion in the S-shape in this manner, even if coefficients of thermal expansion of the printed substrate and the heat generating portion are different from each other, a deformation due to a difference in coefficient of thermal expansion can be absorbed by the shape (the S-shape), so that disconnection in the heat generating portion hardly occurs.

The invention described in claim 8 provides, as another means for solving the problem, a method of manufacturing parts of igniter, comprising: a step of placing a heat generating body on one surface of a header; a step of causing an

electroconductive pin to penetrate the header from the one surface to the other surface thereof; and a holding step of sandwiching the heat generating body between one end portion of the electroconductive pin on the one surface of the header and a header surface to fix the same.

By applying the method of physically holding by means of the one end portion of the electroconductive pin as a holding means for the heat generating body in this manner, use of a welding method and use of a solider and an electroconductive adhesion are made unnecessary so that the problem caused when these are used can be eliminated. Further, since complicated welding or soldering work or the like becomes unnecessary, a manufacturing cost is reduced.

The invention described in claim 9 provides a manufacturing method of parts of igniter described in claim 8, in which the step of causing the electroconductive pin to penetrate is a step of causing the electroconductive pin to penetrate both the heat generating body and the header.

In addition to being capable of positioning of the electroconductive pin and the heat generating body at once, workability is also elevated so that a reliable fixation can be achieved.

The invention described in claim 10 provides a manufacturing method of parts of igniter described in claim 8 or 9, in which the electroconductive pin is a rod like shaped one, and the holding step comprises steps of deforming one end portion of the electroconductive pin and of sandwiching the heat

generating body between the deformed one end portion and a header surface to fix the same.

In case of a conventional welding method, soldering method or the like, a difference occurs in a fixed state of the heat generating body due to variations in welding condition or soldering condition, the difference influences an electric connected state directly, and it also influences a performance of a product. However, in the above invention, since a method of fixing the heat generating body by deforming the one end portion of the electroconductive pin by means of crimping or crushing is adopted, the electric connected state is stabilized without causing variations in a fixed state, so that a performance of a product is also stabilized.

The invention described in claim 11 provides a manufacturing method of parts of igniter described in claim 8 or 9, in which the electroconductive pin is a nail like shaped one having a flange portion at one end portion, and the holding step is a step of sandwiching the heat generating body between the flange portion at the one end portion of the electroconductive pin and a header surface to fix the same.

By using the nail like shaped electroconductive pin having the flange portion at the one end portion, a fixing work for the heat generating body is facilitated and the electric connected state is stabilized without causing variations in a fixed state, so that a performance of a product is also stabilized.

The invention described in claim 12 provides a

manufacturing method of parts of igniter described in claim 8 or claim 9, in which the electroconductive pin has a groove formed in the radial direction on one end portion, and the holding step comprises a step of sandwiching the heat generating body between a groove in the one end portion of the electroconductive pin and a header surface to fix the same.

By using the electroconductive pin having the groove formed in the one end portion thereof in the radial direction, a fixing work for the heat generating body is facilitated, and the electric connected state is stabilized without causing variations in a fixed state, so that a performance of a product is also stabilized.

The invention described in claim 13 provides a manufacturing method of parts of igniter described in any one of claims 8 to 12, in which an undulation is formed on a penetrating portion of the electroconductive pin in the other surface side of the header either before or after the holding step.

By forming the undulation on the penetrating portion, the electroconductive pin is prevented from falling off in the direction opposite to the penetrating portion. When the undulation is formed after the holding step, it is formed on only the penetrating portion of the electroconductive pin, but when it is formed before the holding step, not only the penetrating portion of the electroconductive pin but also a portion thereof which exists in the header can be formed with an undulation. If the undulation is formed even on the portion

of the electroconductive pin existing inside the header in this manner, a falling-off preventing effect for an electroconductive pin can be further elevated and a holding force for the heat generating body is also elevated.

The invention described in claim 14 provides a method of manufacturing parts of igniter, comprising: a step of causing an electroconductive pin having an engagement portion with a heat generating body at one end portion to penetrate a header from one surface to the other surface; a step of causing both ends of the heat generating body to be engaged with the engagement portion of the electroconductive pin on the one surface of the header; and a holding step of sandwiching the heat generating body in the one end portion of the electroconductive pin to fix the same by crimping the engagement portion of the electroconductive pin.

In addition to obtaining an effect similar to that in the invention described in claim 8, since the heat generating body is sandwiched and held only by the one end portion of the electroconductive pin, the heat generating body can be held without being influenced by a shape or a surface condition of the header.

According to the parts of igniter and the manufacturing method of the same, an electroconductive pin and a heat generating body can be firmly connected to each other with a much simple method without applying a welding method, a soldering method, an adhesion method using an electroconductive adhesion to connect the electroconductive pin and the heat

generating body. Further, a manufacturing cost can be reduced as compared with a case in which the welding method, the soldering method, or the adhesion method using an electroconductive adhesion is applied.

Brief Description of the Drawings

Fig. 1 is a schematic vertical sectional view of an igniter assembly including parts of igniter;

Fig. 2 is step diagrams showing one embodiment of a manufacturing method of parts of igniter;

Fig. 3 is step diagrams showing another embodiment of a manufacturing method of parts of igniter;

Fig. 4 is step diagrams showing another embodiment of a manufacturing method of parts of igniter;

Fig. 5 is step diagrams showing another embodiment of a manufacturing method of parts of igniter;

Fig. 6 is a step diagram showing an embodiment in which a catching portion is different from that in Fig. 5;

Fig. 7 is step diagrams showing another embodiment of a manufacturing method of parts of igniter; and

Fig. 8 is step diagrams of an embodiment in which a pushing-in state of an electroconductive pin is different from that in Figs. 7.

Explanation of Numerals

10 igniter assembly

20 parts of igniter

30 heat generating body

40 header

51, 52 electroconductive pin

Preferred Embodiment of the Invention

(1) Embodiment 1

A first embodiment of the present invention will be explained with reference to Fig. 1 and Fig. 2. Fig. 1 is a schematic vertical sectional view of an igniter assembly 10 comprising parts of igniter 20, and Figs. 2 are step diagrams showing a manufacturing method (an assembling method) of the parts of igniter 20.

An outer shape of the igniter assembly 10 can be adjusted according to a gas generator for an air bag to be mounted, but a substantially cylindrical shape is ordinarily adopted as the outer shape.

The parts of igniter 20 include a header 40, electroconductive pins 51, 52, and a heat generating body 30 placed on one surface of the header 40.

The heat generating body 30 is enclosed by a cup 12 and a priming 14 (for example, zirconium/potassium perchlorate) is charged in the cup 12. The cup 12 is surrounded by a resin 16 and the resin 16 is formed integrally with a metal collar 18.

When the igniter assembly 10 is assembled in a gas generator for an air bag, the electroconductive pins 51 and 52 are connected to a power source (an automobile battery) via a connector connected with lead wires.

The igniter assembly 10 shown in Fig. 1 is assembled in

a gas generator for an air bag and ignites and burns a gas generating agent or a transfer charge arranged as needed, so that it contributes inflation and development of an air bag. Manufacturing (assembling) of the parts of igniter 20 used in such an igniter assembly 10 can be performed according to steps such as shown in Fig. 2(a) to Fig. 2(c).

As shown in Fig. 2(a), first, the electroconductive pins 51 and 52 are pushed into two through-holes 45 and 46 provided in the header 40. At this time, the electroconductive pins 51 and 52 may be pushed in the through-holes from one surface 41 to the other surface 42, or they may be pushed in the direction reversed thereto. Even when the electroconductive pins 51 and 52 are pushed in from either direction, one end 51a of the electroconductive pin 51 and one end 52a of the electroconductive pin 52 project slightly from the header one surface 41.

The header 40 shown in Fig. 2(a) comprises a material having a insulating property such as a glass, and shapes and sizes of inner diameters of the through-holes 45 and 46 and shapes and outer diameters of the electroconductive pins 51 and 52 are adjusted such that the electroconductive pins 51 and 52 are press-fitted into the through-holes 45 and 46.

The heat generating body 30 illustrated in Fig. 2(a) is shown with a plan view, and it has a heat generating portion 31, two holes 32 and 33 for allowing penetration of the electroconductive pins, and electroconductive contacting portions 34 and 35 coming in contact with the electroconductive

pins 51 and 52. The heat generating body 30 may comprise the heat generating portion 31 and the contacting portions 34 and 35 formed on a printed substrate by etching.

The electroconductive pins 51 and 52 shown in Fig. 2(a) is made of a deformable metal such as aluminum, stainless steel or the like, and they have a rod like shape as illustrated.

Next, as shown in Fig. 2(b), the one end portion 51a of the electroconductive pin 51 and the one end portion 52a of the electroconductive pin 52, and the heat generating body 3, which are projected from the header one surface 41, are allowed to penetrate two holes 32 and 33 of the heat generating body 30 respectively, and the heat generating body 30 is put on the header one surface 41. Shapes and sizes of the two holes 32 and 33 of the heat generating body 30 cannot be limited as long as the electroconductive pins 51 and 52 penetrate into the holes, and they may be equal to or slightly larger than outer diameters of the electroconductive pins 51 and 52.

In this connection, a state illustrated in Fig. 2(b) may be obtained by putting the heat generating body 30 on the header one surface 41 and then, simultaneously making the two holes 32 and 33 of the heat generating body 30 and the two through-holes 45 and 46 provided in the header 40 penetrated with the electroconducitve pins 51 and 52.

Next, as shown in Fig. 2(c), using a proper pushable tool, the heat generating body 30 is fixed in such a way that the one end portion 51a of the electroconductive pin 51 and the one end portion 52a of the electroconductive pin 52 are deformed in a

crushing manner (or crimped or riveted) and sandwiching the heat generating body between the deformed portions 51a and 52a and the header one surface 41. Assembling of the parts of igniter 20 is completed by this fixing work.

Since the heat generating body 30 can be held by only crashing to deform the one end portions of the electroconductive pins 51 and 52, a complicated welding work or soldering work is made unnecessary, so that a manufacturing cost is also reduced.

A deformed state of the deformed portion is satisfactory as long as the heat generating body 30 can be fixed, and also, such a shape may be adopted that a surface of the deformed portion opposite to the header one surface 41 is flat but a surface not opposite to the header one surface is non-flat (for example, a semi-spherical surface as shown in the drawing). By adopting such a shape, since the heat generating body 30 is sandwiched and held between the deformed portions 51a and 52a in a flat shape and the header one surface 41, a fixing strength is enhanced and also, electric connections between the electroconductive pins 51 and 52 and the electroconductive contacting portions 34 and 35 are surely realized.

Since the gas generator for an air bag is required to operate reliably for 10 years or more which corresponds to the life of a vehicle, it is required in the igniter assembly 10 that, in particular, the heat generating body 30 and the electroconductive pins 51 and 52 are held in an electrically normal contacting state.

In the parts of igniter 20 illustrated in Fig. 2(c), since the heat generating body 30 is sandwiched and fixed between the one end portions 51a and 52a of the electroconductive pins 51 and 52 and the header one surface 41, connection failure hardly occurs due to repetitive stress caused by vibrations or the like during vehicle driving, as compared with a case in which connection is made by welding, soldering or the like.

Further, by adjusting the shapes and the outer diameters of the electroconductive pins 51 and 52 and the shapes and inner diameters of the through-holes 45 and 46 of the header to allow press-fitting of the electroconductive pins 51 and 52, that is, by making the press-fitted electroconductive pins 51 and 52 immovable even with repetitive stress caused by vibrations or the like during vehicle driving, a fixing strength for the heat generating body 30 can be elevated.

In the igniter assembly 10 assembled with the parts of igniter 20, an electric current flows, for example, from the electroconductive pin 51 to reach the heat generating body 30 and flows in the electroconductive pin 52 via the contacting portion 34, the heat generating portion 31 and the contacting portion 35. In this course, the heat generating portion 31 of the heat generating body 30 generates heat to ignite and burn the priming. In the parts of igniter 10 of the first embodiment, since a connection strength between the electroconductive pins 51, 52 and the heat generating body 30 is high, an activation reliability of the igniter assembly 10 is enhanced, and a reliability of the gas generator for an air bag is also enhanced.

(2) Embodiment 2

A second embodiment of the present invention will be explained with reference to Fig. 3(a) to Fig. 3(c). Fig. 3(a) to Fig. 3(c) are step diagrams of a manufacturing method (an assembling method) of parts of igniter 20. In this case, Fig. 3(a), two heat generating bodies are shown in a plan view and a side view respectively, but only a single heat generating body 30 is used.

As illustrated in Fig. 3(a), the heat generating body 30 is put on a header one surface 41. At this time, the heat generating body 30 is placed such that the positions of two through-holes 45 and 46 provided with a header 40 and the positions of two holes 32 and 33 provided with the heat generating body 30 are coincident with each other.

The heat generating body 30 includes a heat generating portion (a heat generating resistance element) 31 and electroconductive contacting portions 34 and 35 formed on a printed substrate 36 comprising a flexible material such as a plastic material, and holes 32 and 33 for allowing penetration of an electroconductive pin are respectively provided in the contacting portions 34 and 35.

In this connection, since the heat generating portion 31 has a very narrow width, it is preferable that the heat generating portion is formed by etching. Further, by forming the heat generating portion 31 in an S-shape, even if the coefficients of thermal expansion of the printed substrate 36 and the heat generating portion 31 are different from each other,

a deformation due to a difference in coefficient of thermal expansion can be absorbed by the shape (the S-shape), so that disconnection of the heat generating portion 31 becomes difficult to occur, which is desirable.

The header 40 shown in Fig. 3(a) comprises a material having an insulating property such as a glass, and the shapes and sizes of the inner diameters of the through-holes 45 and 46 and the shapes and sizes of the outer diameters of the electroconductive pins 51 and 52 are adjusted such that the electroconductive pins 51 and 52 are press-fitted into the through-holes 45 and 46.

The shapes and sizes of the two holes 32 and 33 of the heat generating body 30 is not limited as long as the electroconductive pins 51 and 52 can penetrate into the holes, and the holes may be formed to have sizes equal to or slightly larger than outer diameters of the electroconductive pins 51 and 52.

Next, as shown in Fig. 3(b), the electroconductive pins 51 and 52 are pushed from the header one surface 41 toward the other surface 42 to penetrate the holes 32 and 33 of the heat generating body 30 and the through-holes 45 and 46 of the header 40.

The electroconductive pins 51 and 52 are in a nail like shape having flange portions 53 and 54 at one ends thereof, and back surfaces 53a and 54a of the flange portions 53 and 54 are flat.

Then, as illustrated in Fig. 3(c), the electroconductive

pins 51 and 52 are pushed in until the back surface 53a of the flange portion 53 and the back surface 54a of the flange portion 54 abut against a surface of the heat generating body 30 (electroconductive contacting portions 34 and 35). Assembling of the parts of igniter 20 is completed by this pushing-in work.

At this time, since the back surfaces 53a and 54a are flat, the heat generating body 30 can be held firmly by sandwiching the heat generating body 30 between these flat surfaces and the header one surface 41. Then, since the heat generating body 30 can be held by only penetrating the nail-shaped electroconductive pins 51 and 52 provided with the flange portions, not only a welding work or a soldering work is made unnecessary but also the heat generating body 30 can be fixed by a simple work.

Further, the electroconductive pins 51 and 52 are caused to penetrate the holes 32 and 33 of the heat generating body 30 in advance and, in this state, the electroconductive pins 51 and 52 are caused to penetrate the through-holes 45 and 46 from the header one surface 41, so that assembling is conducted such as shown in Fig. 3(c).

Furthermore, when undulations are formed on rod-shaped portions (portions except for the flange portions 53 and 54) of the electroconductive pins 51 and 52, falling-off or loosening of the electroconductive pins 51 and 52, lowering of a holding force for the heat generating body 30, or weakening of electric connections of the flange back surfaces 53a and 54a and the electroconductive contacting portions 34 and 35 is

prevented in the state shown in Fig. 3(c). In this connection, formation of the undulations on the electroconductive pins 51 and 52 may be conducted before or after the electroconductive pins are caused to penetrates the header 40, and the undulations may be formed on the whole portions (the whole portions of the rod-shaped portions in Fig. 3(b)) or one portions (for example, only penetrated portions in Fig. 3(c), portions abutting against the inner peripheral faces of the through-holes 45 and 46 of the header 40, or only both of the penetrated portion and the abutting portions) of the rod-shaped portions.

(3) Embodiment 3

A third embodiment of the present invention will be explained with reference to Fig. 4(a) to Fig. 4(d). Fig. 4(a) to Fig. 4(d) are step diagrams of a manufacturing method (an assembling method) of parts of igniter 20. In this connection, Fig. 4(a) shows a heat generating body 30 with a plan view, and the heat generating body 30 is the same as that shown in Figs. 3 except that it has no hole.

As illustrated in Fig. 4(a), electroconductive pins 51 and 52 are pushed into two holes 45 and 46 of a header 40. At this time, the pins are pushes in such that grooves 55 and 56 formed on one ends of the electroconductive pins 51 and 52 become parallel with each other and they remain on the header one surface 41.

The electroconductive pins 51 and 52 may be pushed in from the one surface 41to the other surface 42, or they may be pushed from the direction reversed thereto. The relationship between

the shapes and sizes of the electroconductive pins 51 and 52 and the shapes and sizes of the through-holes 45 and 46 is similar to that in Embodiments 1 and 2.

The electroconductive pins 51 and 52 have grooves 55 and 56 formed at respective one ends in widthwise directions thereof. Such a setting is performed that the widths of the grooves 55 and 56 are equal to or less than the diameters of the electroconductive pins 51 and 52, and the lengths of the grooves 55 and 56 (lengths in their axial directions) are larger than the thickness of the heat generating body 30.

Next, as illustrated in Fig. 4(b), the heat generating body 30 is fitted between the groove 55 of the electroconductive pin 51 and the groove 56 of the electroconductive pin 52. As illustrated, since an interval between the groove 55 and the groove 56 is set to the same as the length of the heat generating body 30, the heat generating body 30 may be inserted from formation directions of the groove 55 and 56 (widthwise directions of the electroconductive pins 51 and 52).

Next, as shown in Fig. 4(c), the electroconductive pins 51 and 52 are pushed in until the heat generating body 30 and the header one surface 41 are brought in contact with each other.

By doing so, the heat generating body 30 is fixed by being sandwiched by the grooves 55 and 56 and the header one surface 41 and also, electric connections of the electroconductive pins 51 and 52 and the electroconductive contacting portions 34 and 35 can be obtained. Thereby, since fixation of the heat generating body 30 and the electric connections of the

electroconductive pins 51 and 52 can be achieved by only pushing the electroconductive pins 51 and 52 provided with the grooves 55 and 56, not only a welding work or a soldering work is made unnecessary but also a work is made simple.

Next, as illustrated in Fig. 4(d), undulations 57 and 58 are formed on penetrated portions of the electroconductive pins 51 and 52 toward the header other surface 42. Assembling of the parts of igniter 20 is completed with a formation for the undulations 57 and 58.

The undulations 57 and 58 are for preventing the electroconductive pins 51 and 52 from falling off to the header one surface 41. The undulations 57 and 58 may have constitutions for developing the above-described action, and they may comprise plural projections arranged in a distributing manner, plural annular undulations formed in the axial direction, screw threads formed spirally or the like.

The undulations 57 and 58 may be formed at a stage before the stage shown in Fig. 4(a), namely, at a stage before the electroconductive pins 51 and 52 are caused to penetrate the header 40. In this case, in Fig. 4(c), assembling of the parts of igniter 20 is completed.

Further, when the undulations are formed on the electroconductive pins 51 and 52, as illustrated in Fig. 4(d), they may be formed on only the penetrated portions, they may be formed on only the portions existing in the header 40, or they may be formed on both the portions existing in the header 40 and the penetrated portions (a portion lower than the groove

portion 55 of the electroconductive pin 51 and a portion lower than the groove portion 56 of the electroconductive pin 52).

In the first embodiment shown in Fig. 2, the undulations 57 and 58 can be formed on the electroconductive pins 51 and 52 for achieving a similar effect.

(4) Embodiment 4

A fourth embodiment of the present invention will be explained with reference to Fig. 5(a) to Fig. 5(c). Fig. 5(a) to Fig. 5(c) are step diagrams of a manufacturing method (an assembling method) of parts of igniter 20. In this case, Fig. 5(a) shows a heat generating body 30 with a plan view, and the heat generating body 30 is the same as that shown in Figs. 3 except that it has only a single hole.

A header 40 shown in Fig. 5(a) is made of an electroconductive metal. A catching portion 60 for allowing fitting of one end edge of a heat generating body 30 therein, which has a L-shaped section in a widthwise direction and has a length equal to the width of the heat generating body 30, is formed on header one surface 41.

The catching portion 60 is made of an electroconductive metal. The header 40 provided with the catching portion 60 can be formed integrally by a press-molding or the like.

A single through-hole 46 is provided in the header 40, and an electrically insulating portion 70 (figures are side views, where the insulating portion can not be actually seen but it is shown with oblique lines for easy understanding) is provided around the through hole 46 over the whole thickness

from the header one surface 41 to the another face 42.

The positions of the catching portion 60 and the through-hole 46 of the header 40 are adjusted considering the length and width of the heat generating body 30 and the position of the hole 33, as apparent from the next step.

Next, as illustrated in Fig. 5(b), one end edge of the heat generating body 30 is fitted into an inside space 61 of the catching portion 60, the hole 33 and the through-hole 46 are superimposed with each other, and then, the heat generating body 30 is placed on the header one surface 41.

Thereafter, a nail-shaped electroconductive pin 51 having a flange portion 53 is pushed from the header one surface 41 to penetrate the hole 33 and the through-hole 46.

Next, as illustrated in Fig. 5(c), the electroconductive pin 51 is pushed in until a back surface 53a of the flange portion comes in contact with a surface of the heat generating body 30, so that the heat generating body 30 is fixed. Assembling of the parts of igniter 20 is completed by this fixing work.

By doing so, one end of the heat generating body 30 is held by the catching portion 60 and the other end thereof is sandwiched between the back surface 53a of the flange portion and the header one surface 41, so that the heat generating body 30 is fixed. Thereby, since the heat generating body 30 can be fixed by only pushing the electroconductive pin 51, not only a welding work or a soldering work is made unnecessary but also a work is made simple.

As illustrated in Fig. 6, such a constitution can be

employed that the catching portion 60 is formed of a metal with a large elasticity and a slope is provided on a pressing wall 62, so that a pressing force is applied to the heat generating body 30 in the direction X according to pressing-in of the heat generating body 30 in the depth direction (towards an abutting wall 63) of the catching portion 60 and the heat generating body 30 is fastened further tightly. By doing so, fixation of the heat generating body 30 and electric connection of the contacting portion 34 and the header 40 is made more reliable.

In this case, an undulation may be formed on a penetrated portion of the electroconductive pin 51 in the header other surface side 42 like Embodiment 3 shown in Figs. 4.

Further, besides the method of using the electroconductive pin such as shown in Figs. 2 and applying crimping and riveting to make fixation, the fixing method of using an electroconductive pin having such a groove as shown in Figs. 4 is also applicable.

In this embodiment, such a constitution may be adopted that a connector, which is provided with terminals coming in contact with any portion of the header other surface 42 and the electroconductive pin 51 respectively, is connected so that an electric current flowing from the electroconductive pin 51 flows from the heat generating portion 31 and the catching portion 60 to the header other surface 42.

(5) Embodiment 5

A fifth embodiment of the present invention will be explained with reference to Fig. 7(a) to Fig. 7(c). Fig. 7(a)

to Fig. 7(c) are step diagrams of a manufacturing method (an assembling method) of parts of igniter 20. In this case, in Embodiment 5, an alloy wire (nickel-chrome wire or the like) 80 is used as a heat generating body.

As illustrated in Fig. 7(a), electroconductive pins 51 and 52 are pushed into through-holes 45 and 46 of a header 40.

The electroconductive pins 51 and 52 have similar structures to the electroconductive pins 51 and 52 shown in Fig. 4, and they have grooves 55 and 56, respectively. For this reason, when the electroconductive pins 51 and 52 are pushed in, the grooves 55 and 56 remains on a header one surface 41.

Next, as illustrated in Fig. 7(b), the alloy wire is spanned between the grooves 55 and 56. As illustrated, the length of the alloy wire 80 and the interval between the grooves 55 and 56 are set to be approximately equal to each other.

It is desirable that the grooves 55 and 56 of the electroconductive pins 51 and 52 are directed in the same direction for spanning the alloy wire 80 therebetween, but they may be directed in different directions. When the electroconductive pins 51 and 52 are pushed into the grooves 55 and 56 such that the grooves are directed in the same direction, the alloy wire 80 is arranged as shown in Fig. 8(a), but when the electroconductive pins 51 and 52 are pushed in such that the grooves 55 and 56 are directed in reversely to each other, the alloy wire 80 is arranged as shown in Fig. 8(b).

Next, as illustrated in Fig. 7(c), one end portion 51a of the electroconductive pin 51 and one end portion 52a of the

electroconductive pin 52 are crimped or crushed by an appropriate pressing tools. By this work, the alloy wire 80 is fixed by only the one end portions 51a and 52a of the electroconductive pins 51 and 52 without coming in contact with the header one surface 41. By this fixing work, assembling of the parts of igniter 20 is completed.

In this case, an undulation can be formed on a penetrated portion of the electroconductive pin 51 in the header other surface 42 side as in Embodiment 3 shown in Figs. 4. Besides, such a means can be applied that at least peripheral portions of the electroconductive pins 51 and 52 which abut on the through-holes 45 and 46 of the header 40 are formed in tapered shapes (wedge shapes) so that the electroconductive pins 51 and 52 are fixed more tightly according to pushing-in of the electroconductive pins 51 and 52 into the through-holes 45 and 46. Further, such a taper-shaped (wedge-shaped) electroconductive pin can be applicable to Embodiments 1 to 4.

According to Embodiment 5, not only an effect similar to the other embodiments can be obtained but also the heat generating body (the alloy wire) can be fixed without being influenced by the shape or surface condition of the header 40.